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16. ABSTRACT

This report is intended to supplement the water quality investigations conducted at Dutch Harbor which were reported in PB 269 545. The specific objectives of the 1977 survey were to determine (1) the extent of old (pre-1977) and new deposits of shellfish wastes at the disposal locations on the west side of Amaknak Island, (2) Iliuliuk Harbor, and (3) the hydrogen sulfide levels in recently discharged and old shellfish deposits.

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OCTOBER 1976
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ENVIRONMENTAL
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ANALYSIS DIVISION
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Investigations of Seven Disposal Locations Used by Seafood Processors at Dutch Harbor, Alaska

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February 1978

TABLE OF CONTENTS

	Page
Introduction	1
Summary	5
Survey Methods	11
Survey Results	14
Universal Seafoods and Dutch Harbor Seafoods Disposal Locations	16
Vita Food Products Disposal Locations	24
Pan-Alaska Fisheries Disposal Location	29
Whitney-Fidalgo Seafoods Disposal Location	32
Queen Fisheries Disposal Location	36
Hydrogen Sulfide Analyses	36
References	39

LIST OF FIGURES

		Page
1.	Location of Dutch Harbor, Alaska.	2
2.	Location of the seafood companies (▲) in Iliuliuk Harbor and their nearshore disposal locations (●).	3
3.	The main deposit of shellfish wastes, which consists mostly of shell, located in the old disposal location used by Vita Food Products.	8
4.	The perimeter deposit, which consists of the less dense waste material, located on the south side of the old disposal location used by Vita Food Products.	9
5.	Dead and dying clams located under a 1-2 cm deep layer of shellfish wastes on the north side of the disposal location used by Pan-Alaska Fisheries.	10
6.	Old sludge bed of shellfish wastes covered by a whitish mat of what appears to be bacteria at the old disposal location for Universal Seafoods. Old discharge pipe enters the wastes on the left.	15
7.	Universal Seafoods: Plan and elevation view drawings of shellfish wastes at the disposal location as observed on October 20 and 21, 1976.	18
8.	Universal Seafoods: Plan and elevation view drawings of shellfish wastes at the 1976 disposal location as observed on September 25 and 26, 1977.	19
9.	Universal and Dutch Harbor Seafoods: Plan and elevation view drawings of shellfish wastes at the new disposal location on September 26, 1977.	20
10.	An unidentified rusty-red colored liquor contained in a depression in the sludge bed in the old disposal location used by Universal Seafoods.	22
11.	One of several dead sculpins found in a depression in the sludge bed in the old disposal location used by Universal Seafoods.	23

Figure Page

12. Vita Food Products: Plan and elevation view drawings of shellfish wastes at the disposal location on October 22, 1976. 25

13. Vita Food Products: Plan and elevation view drawings of shellfish wastes at the 1976 disposal location as observed on September 25 and 26, 1977. 26

14. Vita Food Products: Plan and elevation view drawings of shellfish wastes at the new disposal location on September 25, 1977. 28

15. Pan-Alaska Fisheries: Plan and elevation view drawings of shellfish wastes at the disposal location on October 22, 1976. 30

16. Pan-Alaska Fisheries: Plan and elevation view drawings of shellfish wastes at the disposal location on September 26, 1977. 31

17. Whitney-Fidalgo Seafoods: Plan and elevation view drawings of shellfish wastes at the disposal location on October 22, 1976. 33

18. Whitney-Fidalgo Seafoods: Plan and elevation view drawings of shellfish wastes at the disposal location on September 25, 1977. 34

LIST TABLES

Table		Page
1.	Estimated Hydrogen Sulfide (H_2S) concentrations in sludge and water samples from new and old disposal locations.	38

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INTRODUCTION

The seafood industry in the Dutch Harbor-Unalaska, Alaska, area (Figures 1 and 2) has processed mainly shellfish. At this time, king crab is the most important species; however, tanner crab (marketed as snow crab), dungeness crab and shrimp have also been processed. During the 1976 season over 70 million pounds of shellfish were processed, of which approximately two-thirds or 47 million pounds were not utilized and were disposed of as wastes. The total shellfish production by this industry between 1970 and 1976 is estimated to be 310 million pounds, of which roughly 200 million pounds was discharged as wastes to the waters adjacent to Amaknak and Unalaska Islands. In evaluating some of the impacts of these large quantities of shell wastes, the Environmental Protection Agency conducted water quality investigations in this area in 1975 and 1976 (Stewart and Tangarone 1977).

Two methods have been used by the Dutch Harbor processors to dispose of the unutilized shellfish parts (shell and viscera). The most common method is to grind this material and discharge it through a pipe that is submerged in seven or more fathoms of water. In the second method, the ground shell and soft body parts are screened and collected for disposal in a landfill or dumping at an approved deep water disposal site. In the Dutch Harbor area, only one processor uses the second disposal method.

Figure 1. Location of Dutch Harbor, Alaska

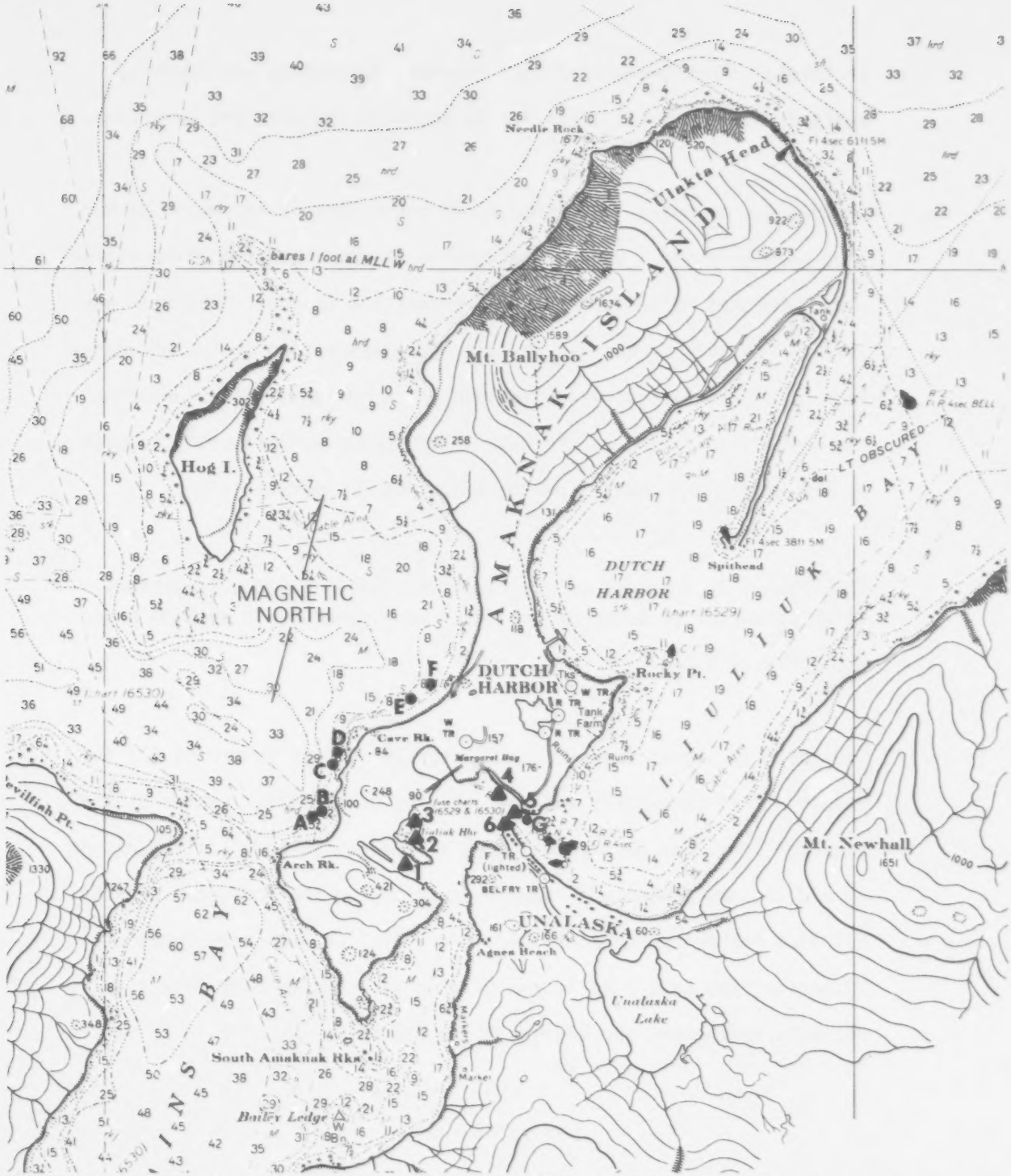


Figure 2. Location of the seafood companies (▲) in Iliuliuk Harbor and their nearshore disposal locations (●).

Legend: ▲ 1. Dutch Harbor Seafoods, 2. Universal Seafoods, 3. Vita Food Products, 4. Whitney-Fidalgo Seafoods, 5. Queen Fisheries, 6. Pan-Alaska Fisheries.
● A. Universal and Dutch Harbor Seafoods, B. Universal Seafoods (old), C. Vita Food Products, D. Vita Food Products (old), E. Pan-Alaska Fisheries, F. Whitney-Fidalgo Seafoods, G. Queen Fisheries (old).

In several other areas of Alaska (Kodiak, Petersburg and Seward), seafood wastes are collected for by-products recovery and reduction.

In 1976 the disposal locations of all processors in the Dutch Harbor area were surveyed. During that survey divers found shellfish wastes which appeared to be from pre-1976 processing seasons. The main purpose of the 1977 survey was to gain more information on the accumulation of old shellfish wastes in some of the disposal locations from one processing season to the next. The survey was primarily focused on the discharges located on the west side of Amaknak Island.

This report is intended to supplement the water quality investigations conducted at Dutch Harbor which were reported in Working Paper No. E.P.A.-910-8-77-100.

The specific objectives of the 1977 survey were to determine (1) the extent of old (pre-1977) and new deposits of shellfish wastes at the disposal locations on the west side of Amaknak Island, (2) the extent of old and new deposits of shellfish wastes on the northeast side of Iliuliuk Harbor at its confluence with Iliuliuk Bay (near Queen Fisheries' M/V East Point), and (3) the hydrogen sulfide levels in recently discharged and old shellfish deposits.

SUMMARY

There were definite accumulations of old (pre-1977) shellfish wastes at each of the four disposal locations observed in 1976 on the west side of Amaknak Island. At two of these locations (Points E and F on Figure 2), the point of discharge appeared to be at the same location as was observed during EPA's 1976 survey. In each of these cases, fresh crab shell and viscera were being deposited directly on top of old shellfish deposits. However, at the other two disposal locations used in 1976 (Points B and D on Figure 2), fresh shellfish wastes were not being discharged because the respective seafood companies had constructed new discharge pipes that were located to the south of the former pipes. In both of these cases, the old deposits were very extensive and new shellfish waste deposits were being created on the bottom (Points A and C on Figure 2).

In an attempt to quantify the accumulations of old and new shellfish wastes at these disposal locations, plan and elevation view drawings of the conditions observed in 1976 and 1977 are used. Some of the shellfish wastes are dispersed by water movement associated with tides, wave surges, and longshore currents. Also, some of the wastes are fed on by aquatic organisms, particularly the visceral organs and tissues that are partially suspended or slowly falling through the water column. However, the reduction of the waste material by these means and by decomposition is not as great as the

rate of waste accumulation from the discharges. The result is that at the present level of shellfish processing the sludge beds will continue to increase in size on the west side of Amaknak Island.

No significant accumulations of old or new shellfish wastes were observed on the bottom on the northeast side of Iliuliuk Harbor near the processor M/V East Point. The divers observed only shallow, remnant deposits of the ground shellfish wastes that were discharged to this area in 1976. Several factors probably account for the comparatively fast recovery of this former disposal location. It is believed that the quantity of waste material discharged was comparatively less than those quantities discharged on the west side of the island. Also, the former discharge line was movable, so the wastes were spread in shallow deposits over a wide area. Water depth in the disposal location varied from 4 to 8 m (13 to 30 ft), so the waste material may have been more exposed to water movement due to tides and wave surges at this natural constriction between the harbor and the bay. Also during both years the divers observed greater concentrations of aquatic organisms (crabs, shrimp and fish) in this area as compared to the disposal locations on the west side of Amaknak Island.

The concentration of hydrogen sulfide (H_2S) was estimated in sludge and water samples. These concentrations, which ranged from 0.1 to 5.9 mg/l, greatly exceeded the 0.002 mg/l concentration that is reported to constitute a long-term hazard for marine aquatic life (EPA 1976).

The adverse impact of the sludge beds on the benthic environment on the west side of Amaknak Island is obvious. The shellfish waste covers the bottom and physically smothers all immobile organisms. The main deposits, which are mostly shell (Figure 3) usually are located within a 30 m radius from the point of discharge. The perimeter deposits (Figure 4), where the less dense waste material settles, covers a larger area that extends well beyond the 30 m radius. The perimeter deposits also extend into deep water areas located on the west side of each disposal location. Due to time and safety limitations, the divers were unable to determine the amount or the western edge of these deposits. Limited observations in 1976 in deep water west of the old disposal location for Universal Seafoods indicate that the sludge beds very likely extend into these areas.

The perimeter deposits apparently do not have to be very deep to impact the benthos. At several locations, dead, dying and what appeared to be stressed clams (Figure 5) were observed under a layer of this material that was only 1-2 cm deep. Also, the benthic communities on the natural substrate in the areas adjacent to the disposal locations had significantly fewer organisms than were present in a "control area" on the same side of the island.

Figure 3. The main deposit of shellfish wastes, which consists mostly of shell, located in the old disposal location used by Vita Food Products.

Figure 4. The perimeter deposit, which consists of the less dense waste material, located on the south side of the old disposal location used by Vita Food Products.

Figure 5. Dead and dying clams located under a 1-2 cm deep layer of shellfish wastes on the north side of the disposal location used by Pan-Alaska Fisheries.

SURVEY METHODS

The accumulation of shellfish wastes at each disposal location on the west side of Amaknak Island was measured during the period of September 25, 26 and 27, 1977 and compared to the bottom conditions observed on October 20, 21 and 22, 1976. In this report the term shellfish is intended to include king and tanner crab and shrimp. However, it appears that most of the waste material comes from processing crab. Some fish wastes and other material may also be discharged by some of the processors.

SCUBA Observations

Two dive teams (4 divers) were used during the survey, which was conducted from a 10 m fishing vessel. While one team surveyed the bottom, the other team tended and obtained any surface time that was required during the repetitive diving. Two additional personnel were aboard to navigate the boat, conduct sulfide analysis, or assist the divers.

Length, width and depth measurements of shellfish deposits were obtained with a 30 m (98ft) line and a 60 cm (2ft) staff. Distances other than 30 meters were estimated by counting diver body lengths or for longer distances the kick (pace) of the swimmer. Depth estimates on the perimeter area between measuring stations

were obtained by projecting the divers arm down into the deposits. For greater depths, estimates were based on evaluating the physical characteristics of the pile, depth gage readings, and comparison with observations taken during the 1976 survey.

Bottom conditions at each of the areas surveyed are presented by disposal location. Approximate plan and elevation views have been sketched from evaluating all the information obtained by the divers. The lines in each plan view of the waste deposits have been drawn to show the general pattern and topography of the accumulations and do not necessarily represent lines of equal waste depth. Also, shellfish wastes deposits were usually present beyond the perimeter (outside) line of the plan view drawing.

An area on the west side of Amaknak Island about one-half mile north of the northern most outfall was chosen to evaluate the benthic flora and fauna in an area not directly influenced by the disposal of shellfish wastes.

Hydrogen Sulfide Analyses

The divers obtained samples of old and new shellfish deposits with a 500 ml glass jar. These samples were brought to the surface and analyzed immediately for total and dissolved sulfide with a LaMotte-Pomeroy Sulfide Testing Set. Hydrogen sulfide (H_2S) in solution is calculated by multiplying the dissolved sulfide concentration by

a H_2S factor, which is dependent on the pH of the sample. The sensitivity of this testing procedure for measuring total and dissolved sulfide is reported to be 0.1 mg/l with an upper limit of detection of 18 mg/l. Samples containing more than 18 mg/l of sulfide must be diluted before testing.

At the time the dissolved sulfide concentrations were measured in samples of new and old shellfish wastes, a pH measuring device was not available. Therefore, the concentrations of H_2S in solution in these samples was not acquired directly for each sample. However, estimates of the respective maximum and minimum H_2S concentrations were obtained by using pH values of 7.0 and 8.5, which was the pH range measured in shellfish waste discharges at Dutch Harbor in 1975.

SURVEY RESULTS

At the time of this survey the processors were discharging fresh king crab wastes, which were easily recognized by their light color and identifiable viscera (e.g., gills) and meat. In older deposits, the surface was usually gray to gray-black in color, covered somewhat by the whitish mat of what appeared to be bacteria (Figure 6) and contained no identifiable soft crab tissues or internal organs. The bottom deposits, particularly the older material, can be easily suspended in the water column producing near zero visibility conditions.

The main piles of shellfish wastes at each disposal location were composed mostly of shell material, which decreased in occurrence with increasing distance away from the point of discharge. The perimeter area around the main deposits appeared to be composed mostly of visceral tissues that were less dense than the shell material.

At this time, five seafood companies grind their wastes and discharge through four pipes that are submerged on the west side of Amaknak Island. The companies with the type of processor(s) in parenthesis are: Universal Seafoods, Ltd. (M/V Unisea); Dutch Harbor Seafoods, Ltd. (M/V Galaxy); Vita Food Products, Inc. (Barge Vita I and M/V Viceroy); Pan-Alaska Fisheries, Inc. (M/V Royal Alaskan and

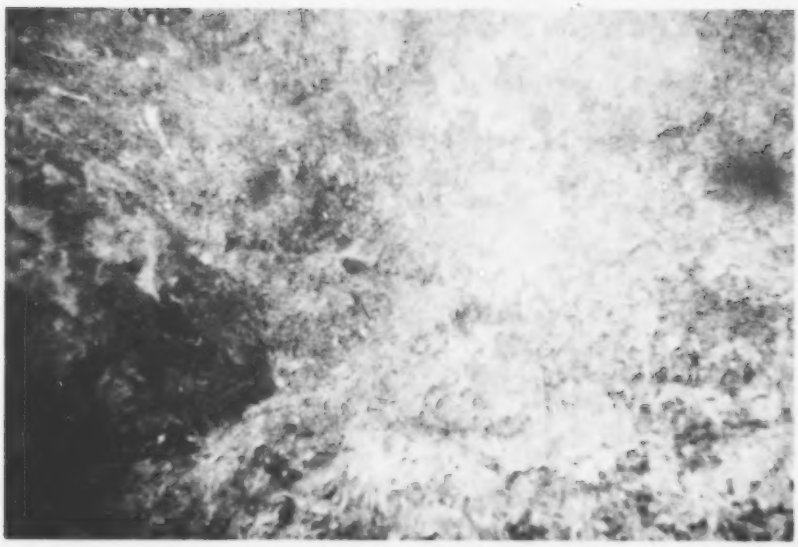


Figure 6. Old sludge bed of shellfish wastes covered by a whitish mat of what appears to be bacteria at the old disposal location for Universal Seafoods. Old discharge pipe enters the wastes on the left.

a shore plant); and Whitney-Fidalgo Seafoods, Inc. (Barge Whitney). Universal and Dutch Harbor Seafoods use the same discharge pipe and presently discharge at point A in Figure 2. Vita Food Products, Pan-Alaska Fisheries and Whitney-Fidalgo Seafoods each have separate discharge pipes and presently dispose of their wastes at points C, E and F, respectively, in Figure 2. Points B and D in Figure 2 represent disposal locations previously used by Universal Seafoods and Vita Food Products, respectively. The location of these seafood companies in Iliuliuk Harbor is also shown in Figure 2.

Queen Fisheries, Inc. (M/V East Point), which is also located in Iliuliuk Harbor, was screening their discharge and disposing of the shellfish wastes in a landfill at the time of our inspection. However, during the 1976 processing season this company discharged ground wastes to a shallow water area on the northeastern side of Iliuliuk Harbor (Point G on Figure 2).

Universal Seafoods and Dutch Harbor Seafoods Disposal Locations

At the time of this survey, this was the southern most disposal location on the west side of the island. However, a new discharge pipe from a shore plant being constructed for Pacific Pearl Seafoods, Inc. will apparently be located just south of this outfall.

On October 20 and 21, 1976, the main deposit of shellfish wastes in the disposal location was 12 m (40 ft) long, 7.5 m (25 ft) wide and 4 m (12 ft) high (Figure 7). The depth of the waste material ranged from 10 to 38 cm (4 to 15 in) at the 30 m radius on the west and north sides of the main deposit. Older (pre-1976) sludge deposits of shellfish wastes 23 cm (9 in) deep were observed by the divers in deep water west of the 30 m radius. The observed accumulation pattern on the bottom indicated that the water currents were carrying most of the light, less dense crab waste in a northerly direction. At the time of the 1976 survey, Dutch Harbor Seafoods' processor M/V Galaxy was not connected to this discharge pipe.

On September 25 and 26, 1977, Universal Seafoods' processor M/V Unisea was not discharging wastes at the same point as was observed in 1976. A new pipe, to which the processor M/V Galaxy was connected, had been placed on the south side of the pipe used in 1976 (Figure 8). The new point of discharge was about 40 m (130 ft) to the southwest and in deeper water than the former point of discharge (Figure 9). It was also noted that more crab wastes were present in the former disposal area in comparison to its condition during the 1976 survey (compare Figures 7 and 8). Undoubtedly, this additional material came from shellfish wastes discharged after EPA's October 1976 survey.

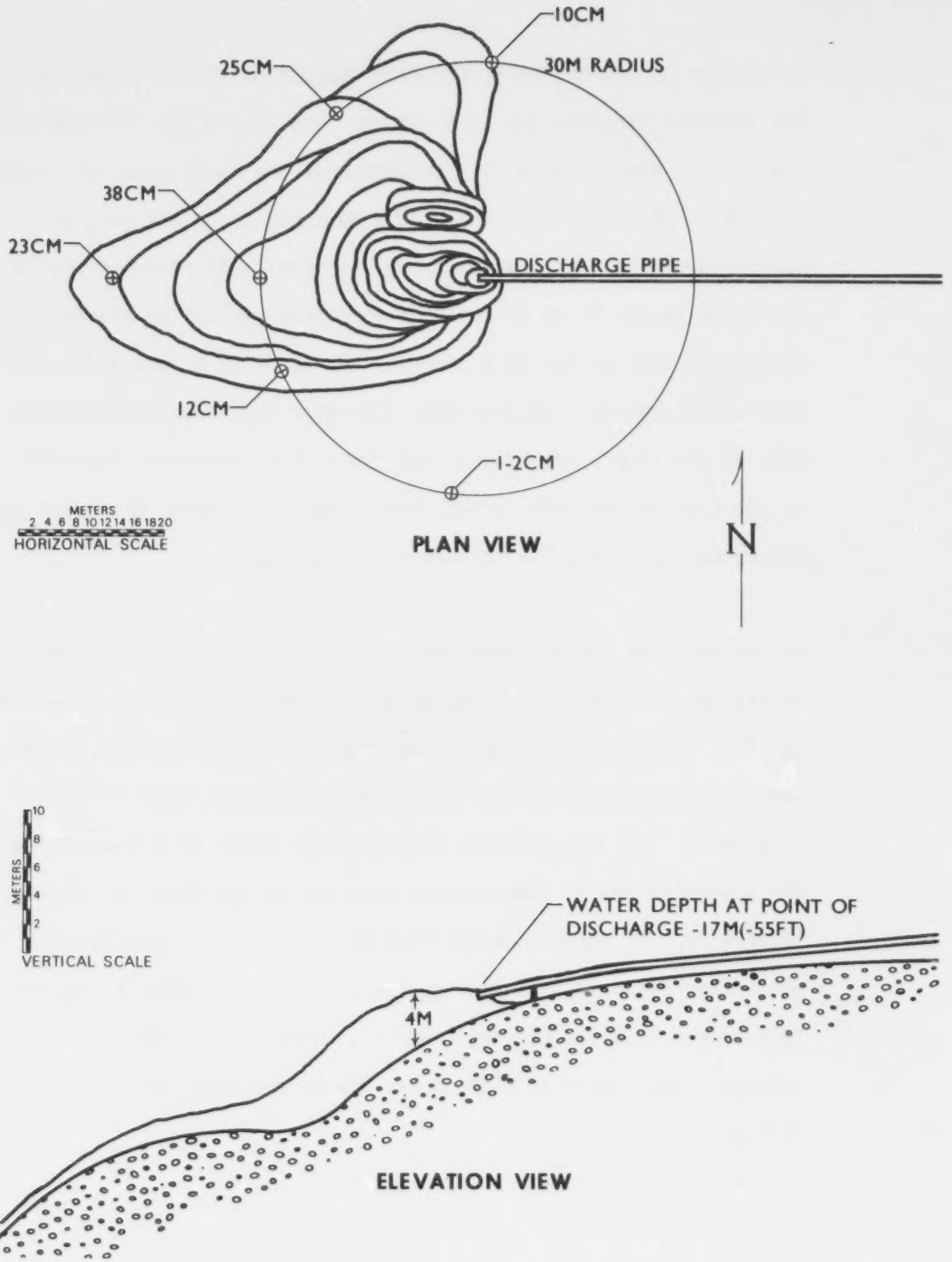
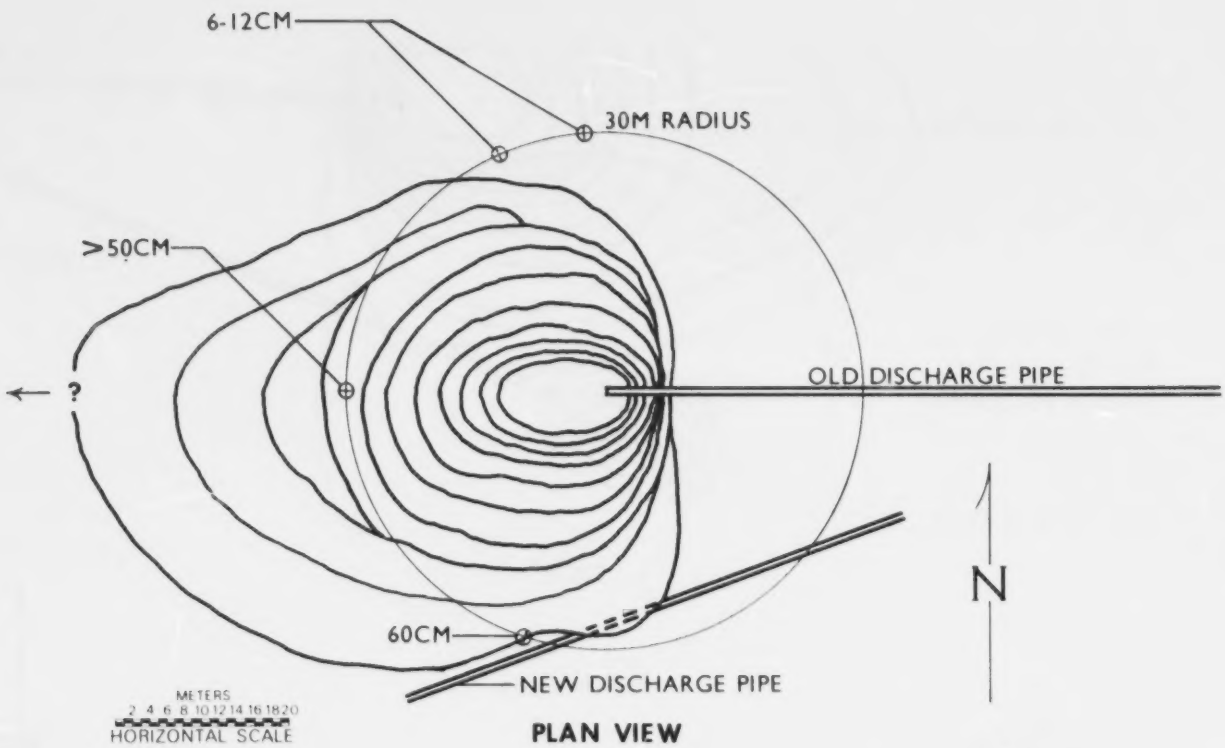


Figure 7. Universal Seafoods: Plan and elevation view drawings of shellfish wastes at the disposal location as observed on October 20 and 21, 1976.



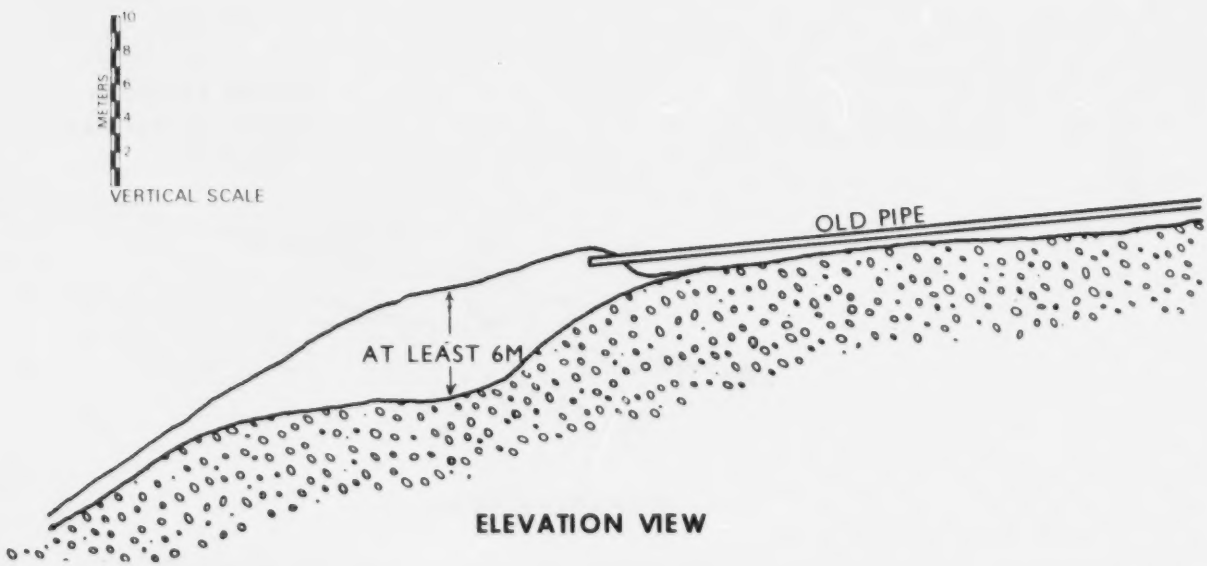
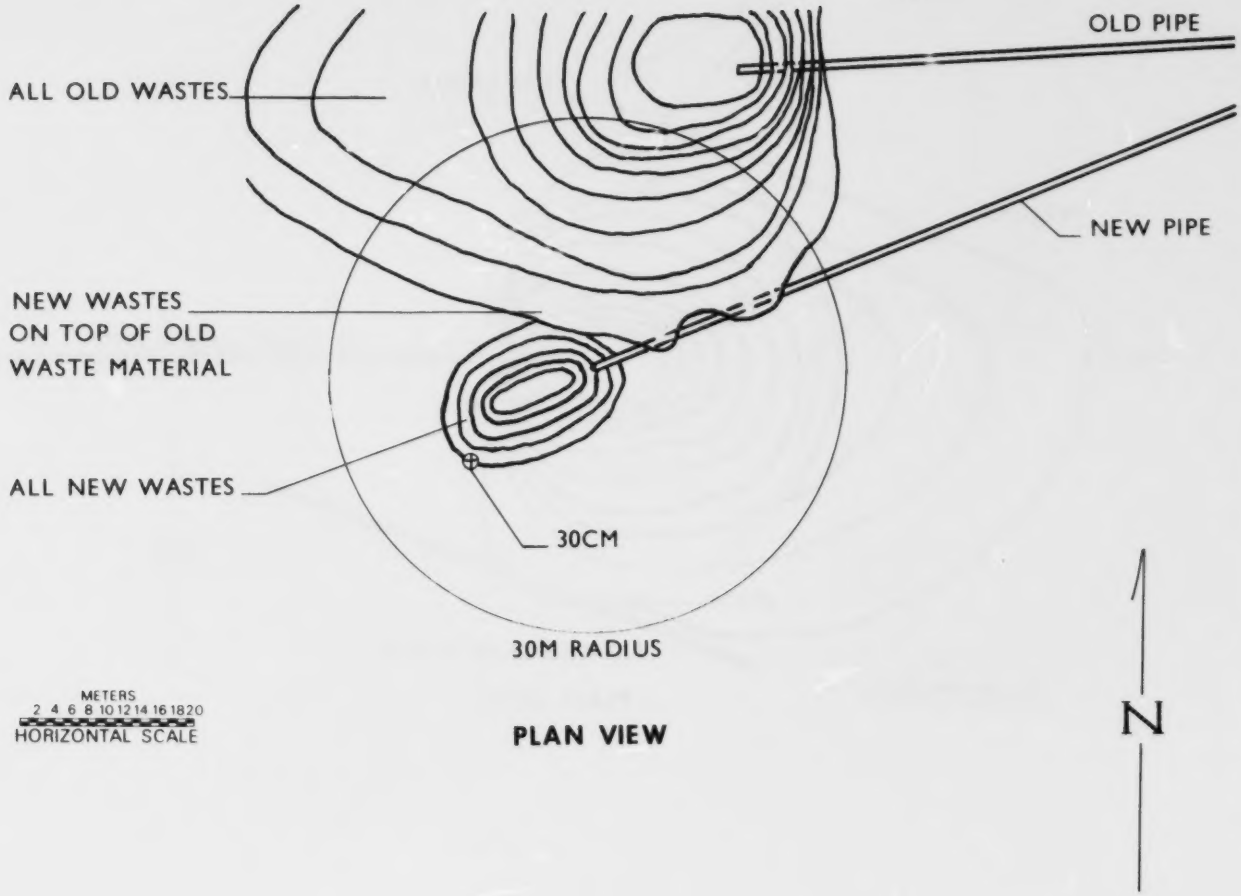


Figure 8. Universal Seafoods: Plan and elevation view drawings of shellfish wastes at the 1976 disposal location as observed on September 25 and 26, 1977.



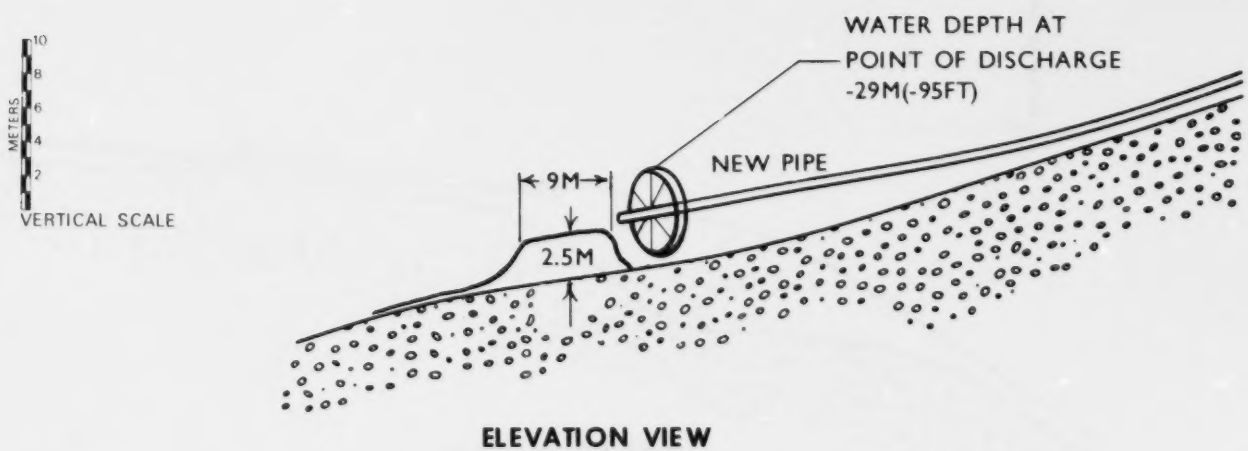


Figure 9. Universal and Dutch Harbor Seafoods: Plan and elevation view drawings of shellfish wastes at the new disposal location on September 26, 1977.

The profile of the old shellfish deposits was generally rounded, except for an occasional narrow crevice or shallow depression. These irregular lower areas commonly contained an unidentified rusty-red colored liquor which had a density greater than water (Figure 10). Dead sculpins about 15 to 20 cm (6 to 8 in) in length were also found in some of the depressions (Figure 11).

The new discharge point is at a water depth of approximately - 29 m (-95 ft) (Figure 9). Fresh crab wastes were accumulating immediately adjacent to the sludge beds created by discharge from previous years. Some of the light, less dense wastes were being carried by the water currents onto the south side of the old (pre-1977) deposits. These older deposits are estimated to be at least 6 m (20 ft) deep throughout much of the northern one-half of the 30 m radius from the present point of discharge.

Dense schools of baitfish and several cabezons and starry flounders were present in the new discharge area and appeared to be feeding on fresh crab wastes. However, these fish were not observed feeding on old shellfish wastes. No large invertebrates (such as crabs, shrimp, urchins, starfish, snails, etc.) were observed on or near the new or old wastes.

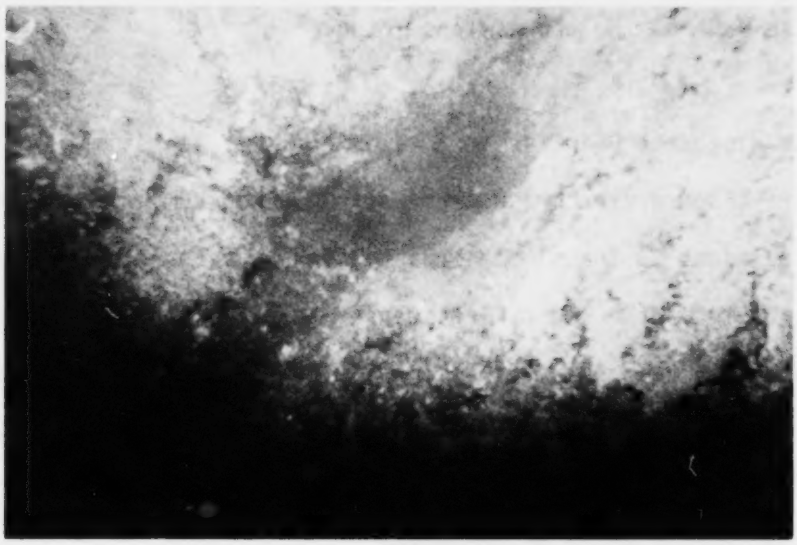


Figure 10. An unidentified rusty-red colored liquor contained in a depression in the sludge bed in the old disposal location used by Universal Seafoods.

Figure 11. One of several dead sculpins found in a depression in the sludge bed in the old disposal location used by Universal Seafoods.

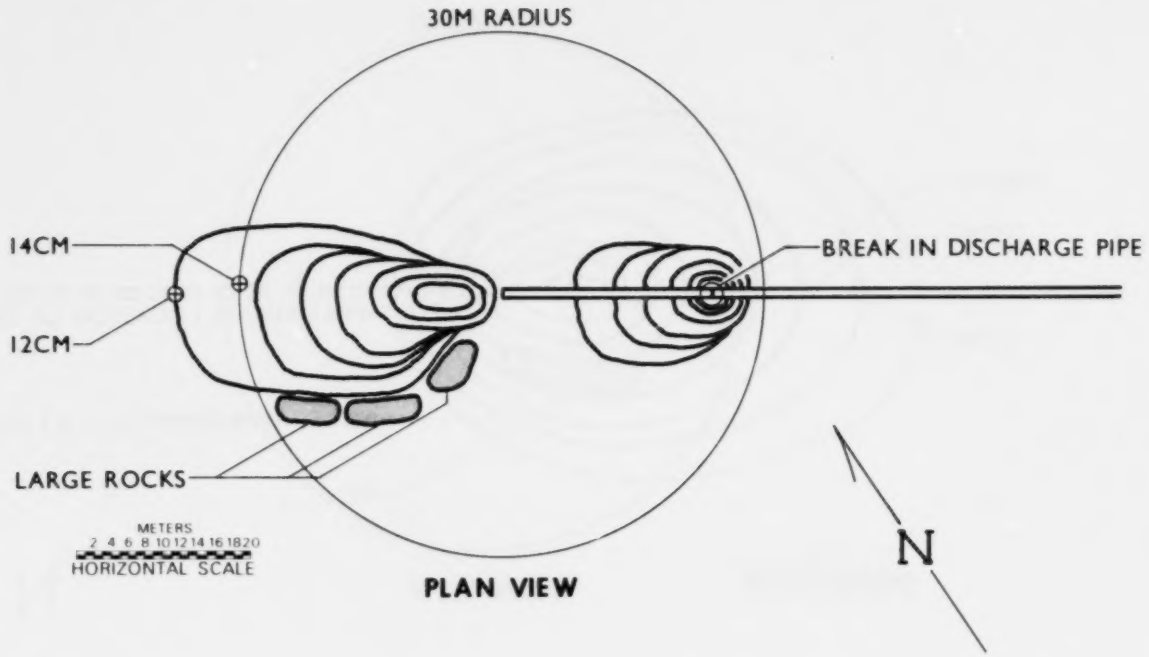
The native substrate on the north, shoreward and south sides of these wastes deposits is a mixture of about 10 to 20 cm (4 to 8 in) cobble, smaller rock, sand and silt.

Vita Food Products Disposal Locations

On October 22, 1976 the shellfish wastes in the disposal location were approximately 12 m (40 ft) long, 6 m (20 ft) wide, and 4 m (12 ft) high in the main deposit off the end of the discharge pipe (Figure 12). However, the discharge pipe was broken about 23 m (75 ft) from the end, which resulted in a secondary deposit 2 m (6 ft) high by 12 m (40 ft) long on the shoreward side of the main pile. The wastes from each pile were overlapping at that time. The less dense crab wastes had been deposited by the water currents on the south side of the main pile.

On September 25 and 26, 1977, it was noted that this outfall had been moved approximately 100 m (330 ft) to the south of the 1976 location, and the water depth was about -23 m (-75 ft) at the new discharge point. According to a representative from this company, the pipe was moved a few weeks prior to our arrival.

This year there was considerably more material in the old disposal area than was present in 1976 (compare Figures 12 and 13). The former discharge pipe could not be located so a large 6 m (20ft)



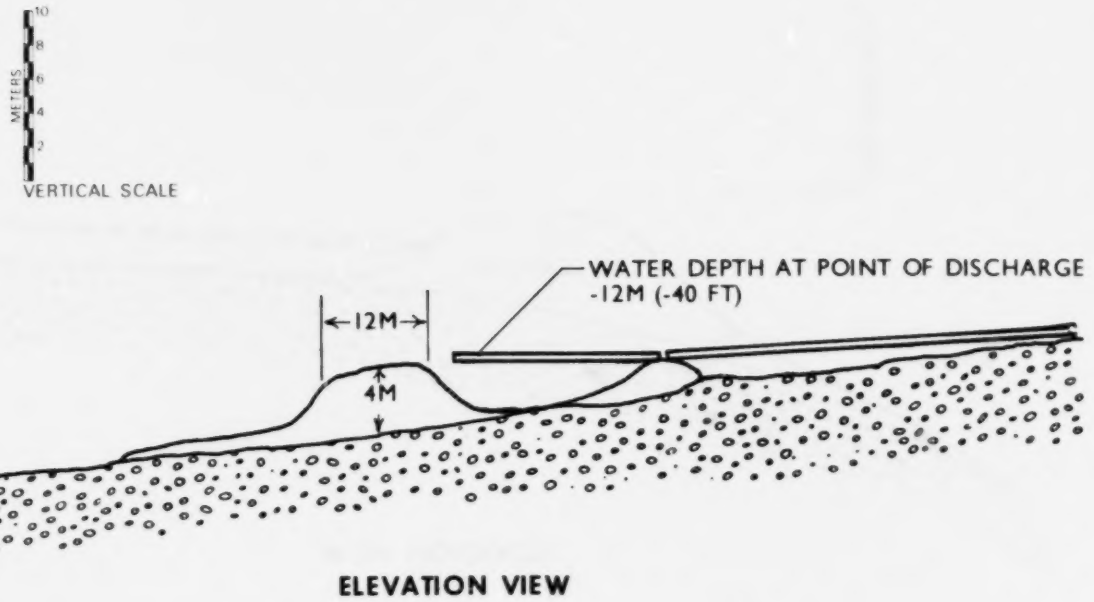


Figure 12. Vita Food Products: Plan and elevation view drawings of shellfish wastes at the disposal location on October 22, 1976.

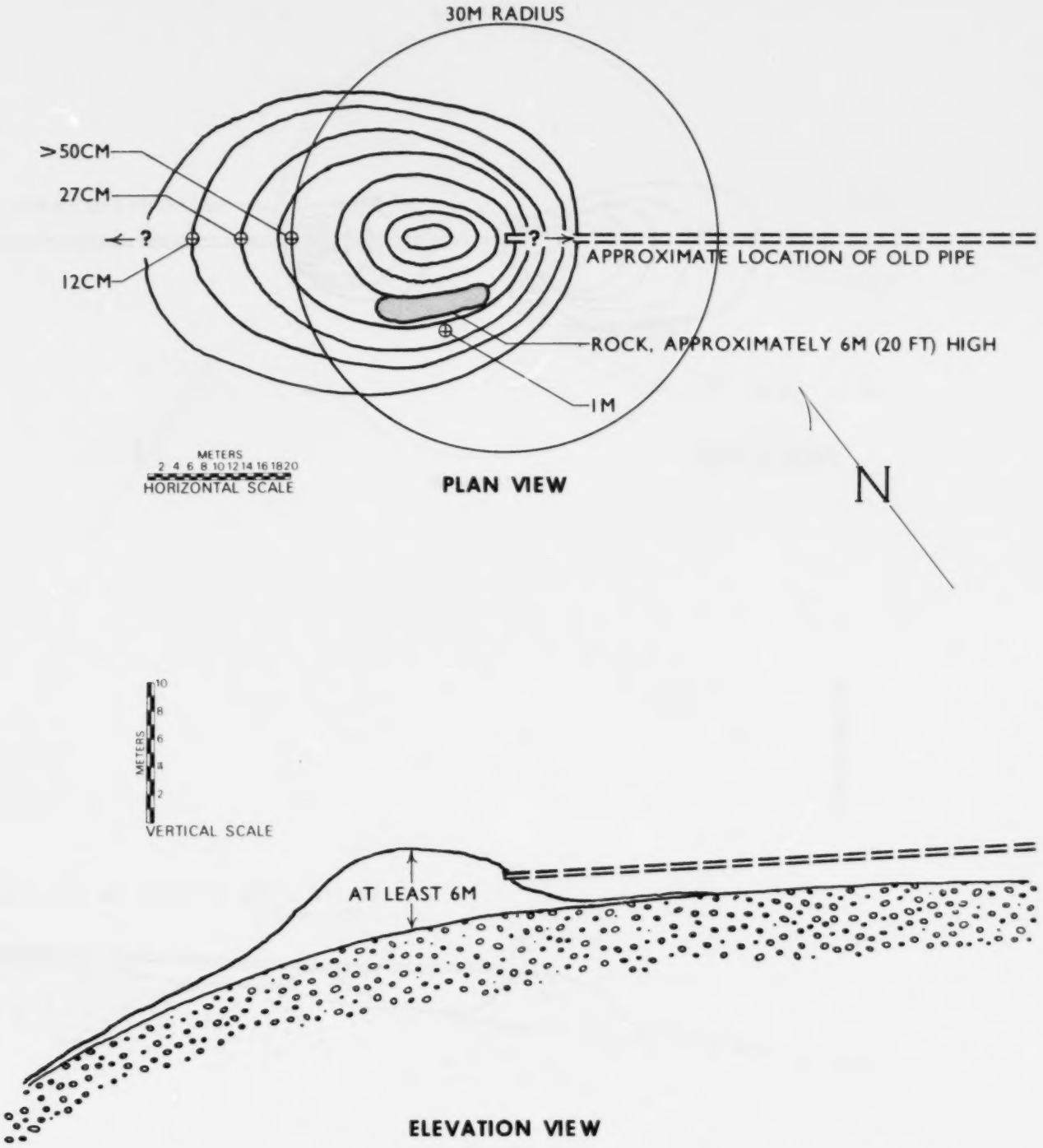


Figure 13. Vita Food Products: Plan and elevation view drawings of shellfish wastes at the 1976 disposal location as observed on September 25 and 26, 1977.

high rock, which was nearly buried in the wastes, was used for reference. During the 1976 survey no wastes were observed south of this rock. This year the entire area south of the rock was covered up to a depth of about 1 m with light, ground crab wastes (Figures 4 and 13).

As shown in Figure 13, the main pile at the old disposal location is quite large. The length, width and depth of the main deposit are estimated to exceed 36 m (120 ft), 15 m (50 ft) and 6 m (20 ft), respectively. Some of the shells on top of the pile appeared to be more recent than the waste deposits in the perimeter area. The main deposit was surrounded by an extensive, relatively shallow, covering of shellfish wastes which appeared to consist mainly of decomposing crab viscera and other tissues with densities less than the comparatively thick leg and carapace crab shell. These less dense wastes were present in depths up to 7 cm (2.5 in) on the -23 m (-75 ft) water depth contour between the old and new disposal locations. At a point 30 m north of the new disposal area, this shallow layer consisted of new and old wastes (Figure 14).

Since the new discharge line had apparently been in operation only a few days, only a small amount of crab shell and wastes was present at the new disposal location (Figure 14). On the south side of this deposit, a patchy, 1-2 cm deep layer of the light, less dense wastes

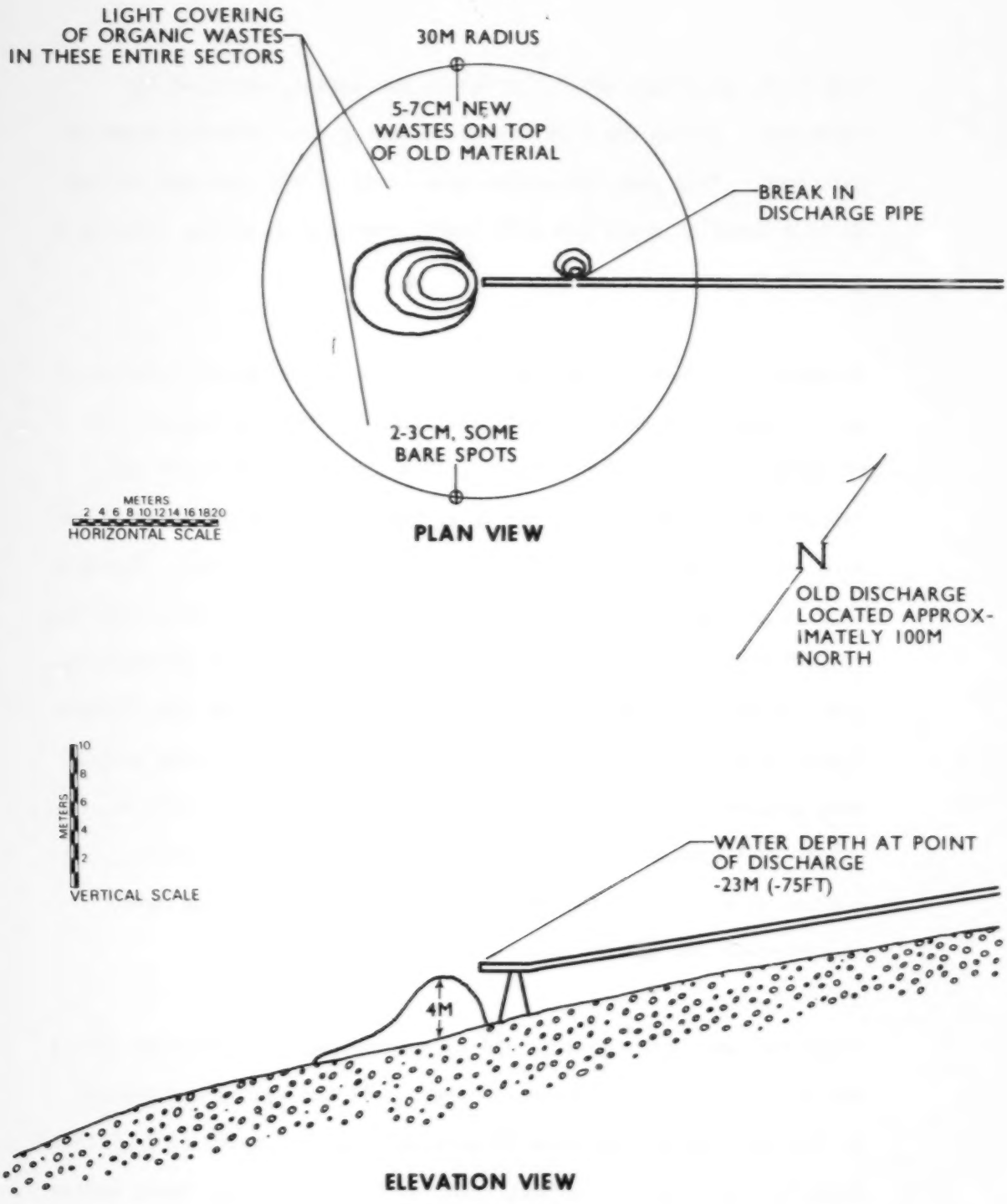


Figure 14. Vita Food Products: Plan and elevation view drawings of shellfish wastes at the new disposal location on September 25, 1977.

extended from the main pile to the 30 m radius. Many clams, which appeared to be stressed, were moving up to the surface under this layer.

Many small schools of baitfish were present at both the old and new disposal areas. Sculpins, blennies, starry flounders, and other flatfish were also present. The only large invertebrates observed in both new and old disposal locations were urchins and small crabs.

The bottom on the north side of the old disposal location was mostly large cobble with some areas of small, sand and silt. However, some large rocks were protruding from the wastes along the south margin of the old deposit. A cobble, sand and silt substrate was observed between the old and new disposal areas and south of the new one.

Pan-Alaska Fisheries Disposal Location

On October 22, 1976, the deposit of shellfish wastes was somewhat long and narrow as compared to the accumulation patterns previously discussed. The main pile was approximately 18 m (60 ft) long, 6 m (20 ft) wide, and 2.5 m (8 ft) high (Figure 15). Also, as observed at the other disposal areas, the perimeter area was covered by a shallow layer of less dense crab viscera and soft body tissues. On the north side of the main pile, 20 to 30 dead and dying clams were observed in an area covered by wastes only 1-2 cm in depth (Figure 5).

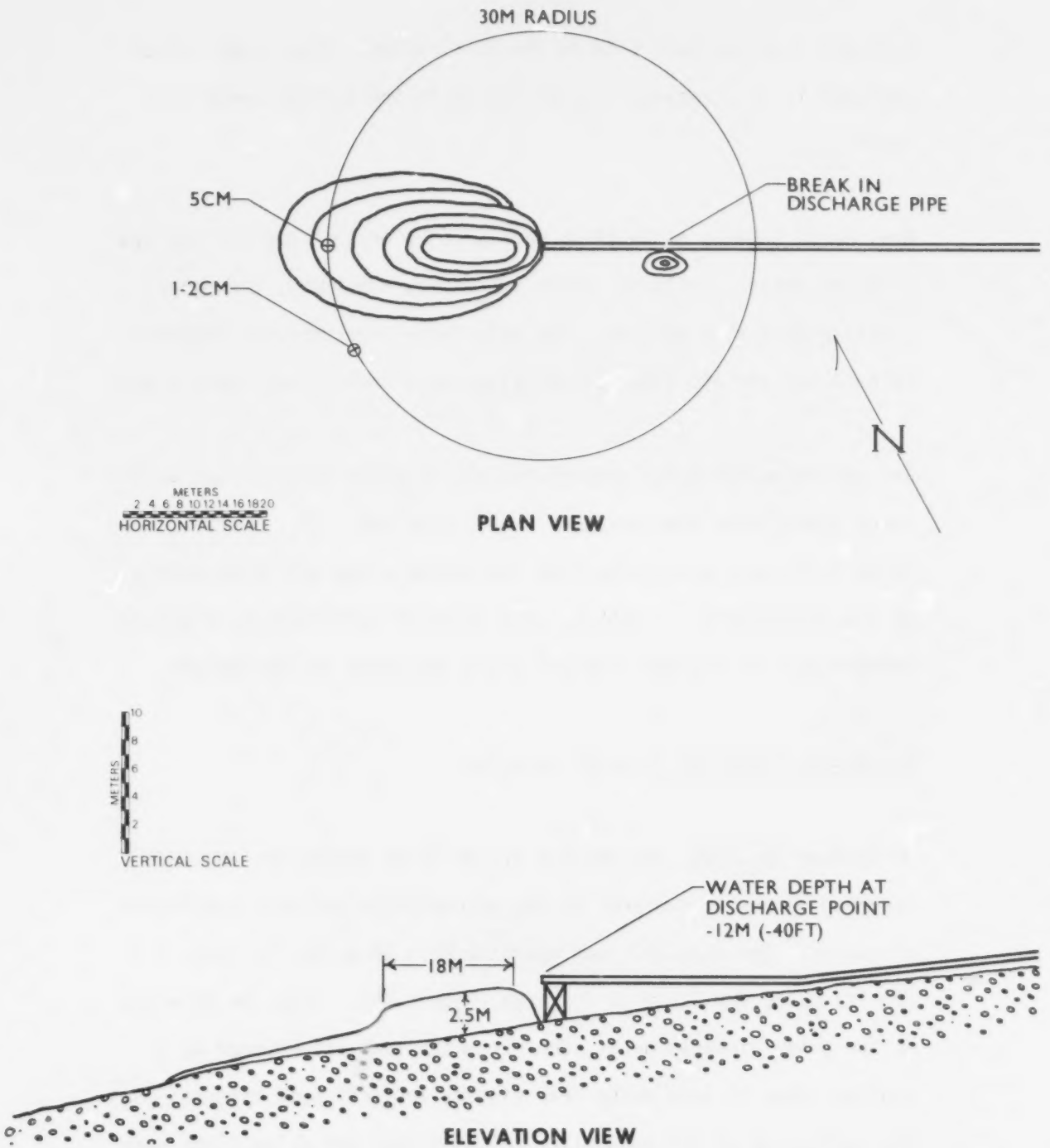
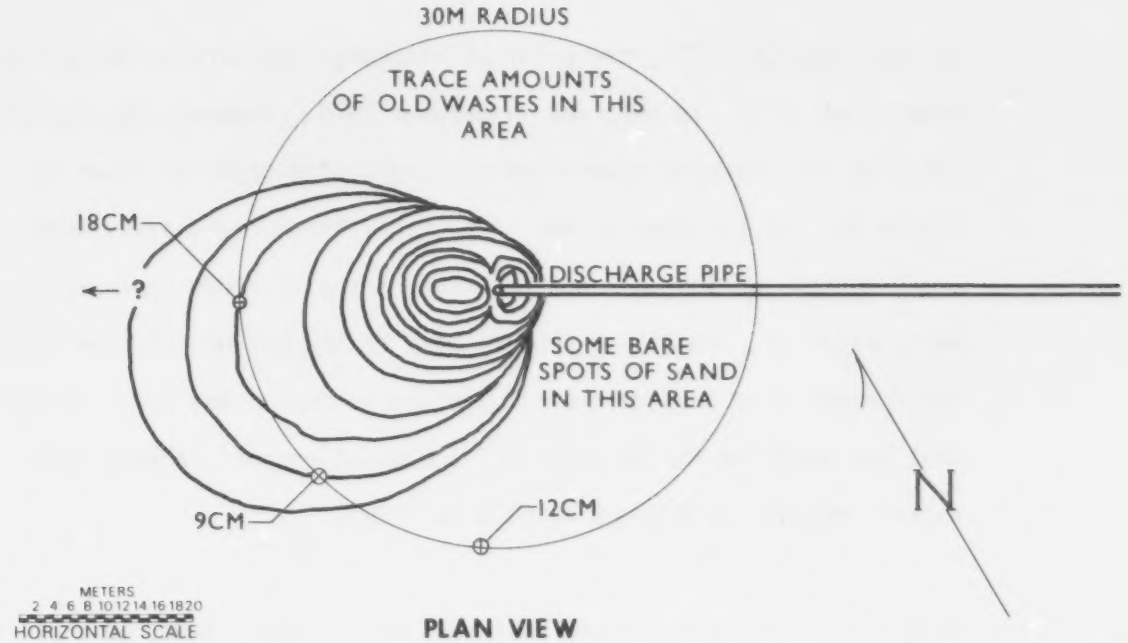


Figure 15. Pan-Alaska Fisheries: Plan and elevation view drawings of shellfish wastes at the disposal location on October 22, 1976.



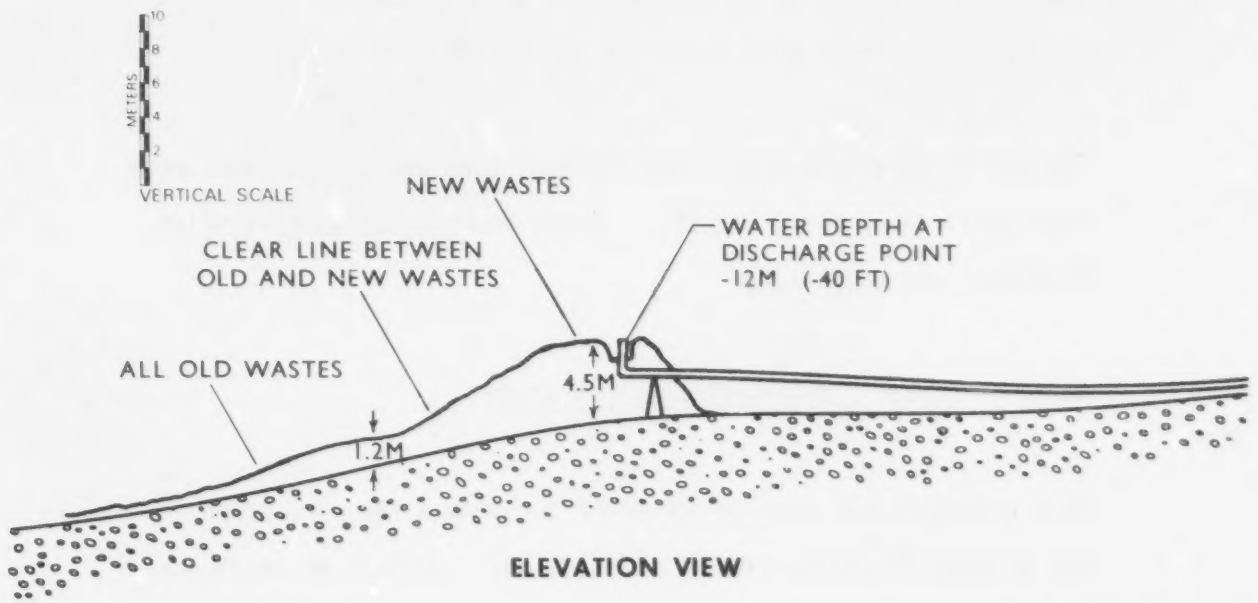


Figure 16. Pan-Alaska Fisheries: Plan and elevation view drawings of shellfish wastes at the disposal location on September 26, 1977.

On September 26, 1977, the point of discharge appeared to be in the same location as was observed in October 1976. However, the end of the pipe was directed upward and slanted to the north as shown in Figure 16. At the time of the inspection, fresh crab wastes were being discharged and were accumulating on top of older (pre-1977) waste material. About 6 m (20 ft) west of the end of the pipe there was a clear line between the old and new wastes on the pile. Further west and south on the 30 m radius, accumulations of old shellfish wastes ranged from 9 to 18 cm (3.5 to 7 in).

As was observed at Universal Seafoods' old disposal area, some of the depressions in the older deposits contained an unidentified rusty-red colored liquor which was denser than water. The divers also observed that the wastes appeared to be accumulating more in the southern sector than was noted during the 1976 survey.

The native substrate around the disposal area was mostly sand, with some small rock, shell and silt. Organisms present were baitfish, flatfish, and sculpins.

Whitney-Fidalgo Seafoods Disposal Location

This processor had been in operation for only a few days prior to our October 22, 1976, inspection, so a small deposit of shellfish wastes was in the disposal area (Figure 17).

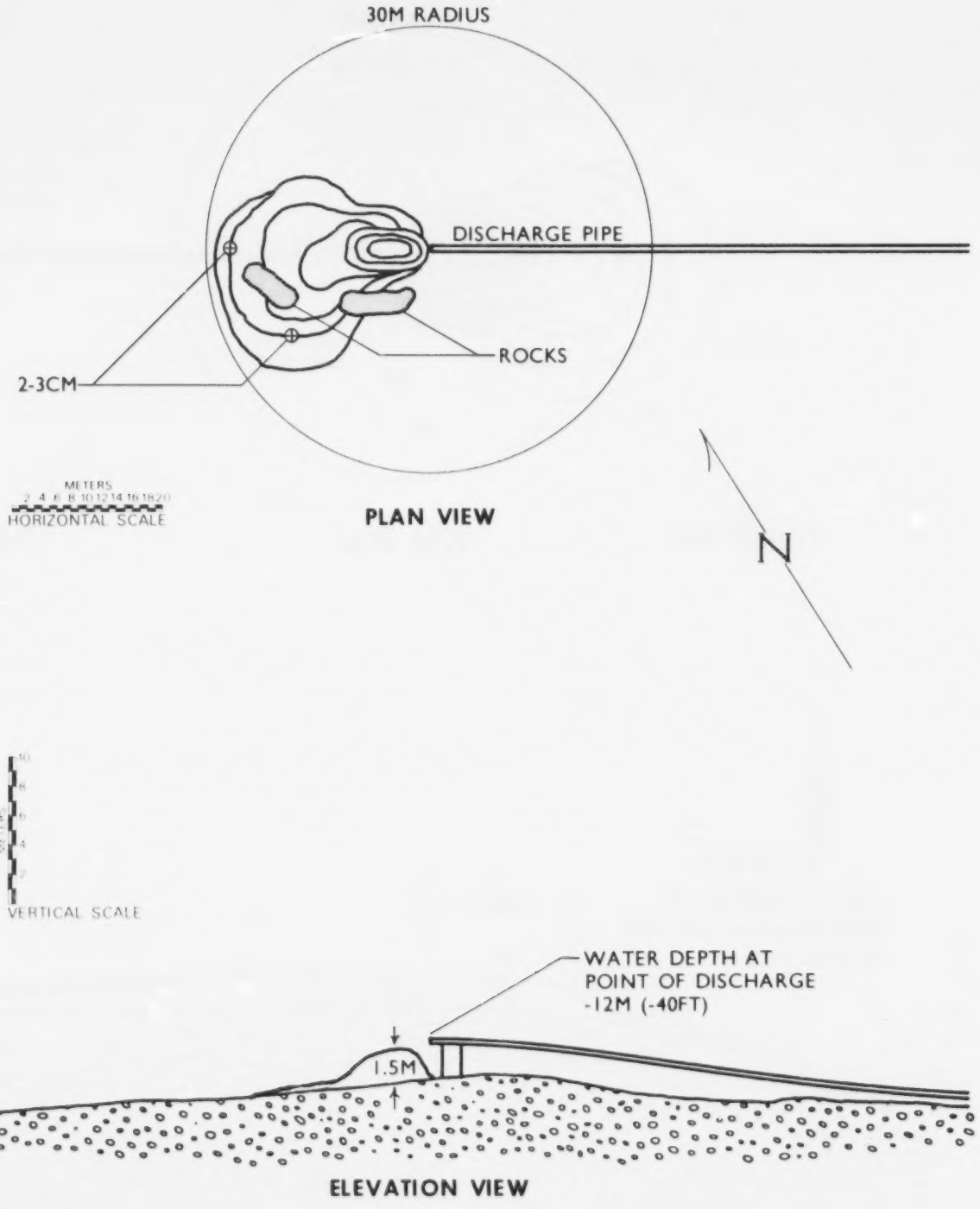


Figure 17. Whitney-Fidalgo Seafoods: Plan and elevation view drawings of shellfish wastes at the disposal location on October 22, 1976.

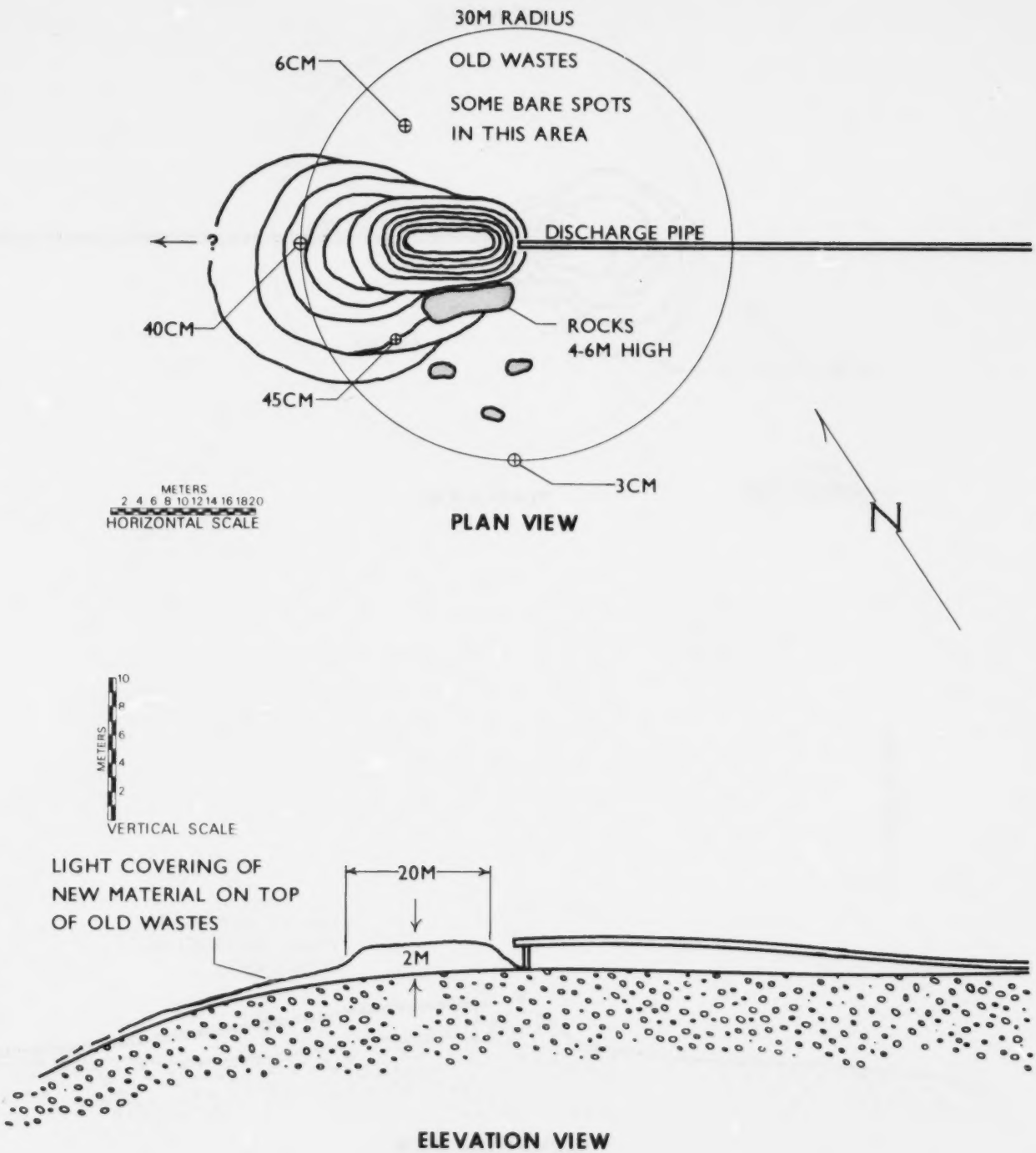


Figure 18. Whitney-Fidalgo Seafoods: Plan and elevation view drawings of shellfish wastes at the disposal location on September 25, 1977.

On September 25, 1977, however, there was considerably more material in the disposal area. The main pile was about 20 m (65 ft) long, 6 m (20 ft) wide and 2 m (6-7 ft) deep (Figure 18). At the 30 m radius on the the west side, the wastes were 40 cm (16 in) deep, and the sludge bed extended well beyond that distance. As was observed at the Pan-Alaska Fisheries disposal area, which is located nearby (see Figure 2), the less dense waste material appears to be accumulating at a faster rate on the south side of the outfall area.

The fresh crab wastes discharged at this location during the inspection appeared to be evenly covering the older (pre-1977) wastes. At many locations, particularly near the 30 m radius, the grayish black layer of old wastes could be easily recognized under the light colored fresh material. For example, the new material represented less than 2.5 cm (1 in) of the 40 cm waste depth measured at 30 m west of the point of discharge.

The native substrate around this disposal location is mostly sand, with some rocks, shell and silt. However, some large rocks up to 6 m (20 ft) high were scattered on the southern side of the disposal area. Baitfish, flatfish and sculpins were observed in the outfall area.

Queen Fisheries Disposal Location

The bottom was surveyed for shellfish wastes on the north side of Iliuliuk Harbor in the areas west, under and east of Queen Fisheries' processor M/V East Point. No significant deposits of fresh or old shellfish wastes were observed in these areas. However, there was a light (less than 1 cm deep) deposit of crab meat and other tissues on the bottom approximately under the processing vessel. Considerable numbers of tanner crabs, shrimp, sculpins, flatfish, and other species were observed in the immediate area of this deposit.

Intermittent patches of nearly decomposed crab wastes were present in the area east of the processor that was used for disposal in 1976. The irregular patches were roughly 1.5 m (5 ft) wide, 3 to 6 m (10 to 20 ft) long, and appeared as shallow surface deposits. Epifaunal and floral organisms were attached to solid substratum throughout this area.

Hydrogen Sulfide Analyses

The measured dissolved sulfide and estimated minimum and maximum H_2S concentrations in samples taken from new and old disposal locations are contained in Table 1. It is apparent that the decay of the massive accumulations of shellfish wastes in the disposal locations on the west side of Amaknak Island is under anaerobic conditions. These conditions cause the formation of extremely high

concentrations of dissolved sulfides, part of which is H_2S. It was noted that H_2S was sufficiently abundant to form bubbles, which were observed raising to the surface by both diving and surface personnel. In some areas the divers also experienced skin and eye irritation and could smell the sulfides in the water.

Table 1. Estimated hydrogen sulfide (H_2S) concentrations in sludge and water samples from new and old disposal locations.

Date	Disposal Location	Type	Total Dissolved Sulfide mg/l	H_2S Concentration (estimated range)* mg/l
9/25/77	Universal Seafoods (old area)	Old sludge & water mix	15	0.3 - 4.9
9/25/77	Vita Food Products (old area)	Old sludge & water mix	18 (est. 50)	0.4 - 5.9
9/26/77	Pan-Alaska Fisheries	Old sludge & water mix	9	0.2 - 3.0
		Water column 30 cm above sludge bed	7	0.1 - 2.3
9/26/77	Universal & Dutch Harbor Seafoods (new area)	New shellfish wastes & water mix	8	0.2 - 2.6
9/26/77	Universal Seafoods (old area)	Water column 30 cm above sludge bed	18 (est. 20)	0.4 - 5.9
9/27/77	Pan Alaska Fisheries (under dock in Iliuliuk Harbor)	Old sludge & water mix	0	0
		Water column 30 cm above sludge bed	0	0

* The minimum and maximum H_2S values given were calculated from pH values of 8.5 and 7.0, respectively.

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GPO 985-296